of terms employed. The plates appear to be carefully drawn and are artistically excellent. A careful examination of the book leaves a delightful impression upon the mind. It is in many respects a model of monographic treatment, and the editor, Dr. A. E. Shipley, is quite right in saying that whereas

> Dr. David Sharp in the Fifth Volume of the "Cambridge Natural History" states: "The classification of the earwigs is still in a rudimentary state." . . . Burr's work will cause the deletion of this sentence if a new edition of Dr. Sharp's volume be called for.

The author of the work intimates that he is engaged in preparing upon the same lines an account of the Dermaptera of the entire world. The appearance of such a work will certainly be welcomed, and the present reviewer hopes that the learned author may be spared in health to complete it at no distant day.

W. J. Holland

Carnegie Museum,
March 15, 1910

SPECIAL ARTICLES

CANAL-RAY EFFECTS IN OPEN AIR DISCHARGE

In a paper recently published[1] the writer has shown that the positive luminescence in a Geissler tube is due to a progressive ionization of the air column, and that this ionization begins at the anode wire. In a long tube like that used by J. J. Thomson, this ionization may extend over a distance of fifteen meters.

Since the publication of the paper, evidence has been secured on photographic plates, showing that a disruptive spark discharge in open air can not be produced, until such ionization, originating at the anode terminal, has reached the negative terminal.

Confirmation of this conclusion may be obtained in the manner now to be described. We have used a large eight-plate influence machine.

Small spark-knobs are so adjusted that a torrent of loud sparks passes between them. Hang midway between the knobs a sheet of copper. It is suspended on long silk threads, its plane being at right angles to the line joining the knobs. The sparks can not now be made to pass. A column of positive luminescence joins a positive terminal and a copper plate, but the cathode half of the gap is dark. A glass rod interposed in the positive luminescence casts a shadow on the side turned away from the anode. The shadow is not bounded by right lines, as is the case in rarefied air, where the mean free path is great. When the rod is held near the copper plate, a shadow is, however, cast on the plate. If the plate is moved to a parallel position near the negative terminal, a torrent of sparks passes through the plate. If moved in the opposite direction, until it makes contact with the positive knob, no sparks will pass in any position of the plate. A negative inflow to the edges and corners of the plate is now taking place, as is shown by brush "discharges," but the ionization effects are dispersed in such a way that the conducting channel or channels through the air do not lead to the negative terminal, and no spark can pass unless the spark gap is made shorter.

We have here a clear explanation of the reason why the spark length is greater, when the positive terminal is a small knob than when it is a large one.

A small windmill was placed in the positive luminescence, with its plane of rotation at right angles to the discharge. The vanes were of thin mica sheet. The diameter from tip to tip of the vanes was 8 cm. The vanes were mounted on a hub of hard rubber having a shaft of vulcanized fiber, and turning on pivots of fiber or glass, mounted in hard rubber. The vanes rotated in a direction which showed that the air was drifting away from the positive terminal. As nearly as could be estimated, the rotation was such as was produced by carrying the mill through still air with a velocity of 1.5 meters per second.

All of the results described are produced when the negative terminal is grounded.

These phenomena show that in all probability an X-ray tube will be much less likely to suffer puncture, if its cathode is grounded.

[1] *Trans. Acad. of Sc. of St. Louis*, Vol. XIX., No. 1.

In that case the cathode discharge is (to use a figure of speech) drawn through, rather than forced through the tube. Their bearing on lightning protection may also be of importance.

FRANCIS E. NIPHER

A PRELIMINARY REPORT OF A NEW BLOOD PICTURE

THE fact that the white blood cells and particularly the neutrophiles of the blood react to certain bacilli and certain toxins in such a definite way is of great assistance to the differential blood count either in diagnosis or in prognosis.

Arneth[1] first showed something of this in his papers upon tuberculosis where he showed that while blood of a normal person contains neutrophiles which have nuclei from one to five lobes, that of a tubercular person contains neutrophiles whose nuclei have only one, two or three lobes.

A study of the neutrophiles of normal blood shows that they can be divided into five groups according to the number of the lobes of the nucleus, *i. e.*, Group I., those neutrophiles which contain a single lobed nucleus; Group II., those which contain two lobes and so on up to Group V., which contains those neutrophiles which have five lobes to the nucleus. The number of neutrophiles in these different groups, where one hundred neutrophiles have been counted, forms what may be called the differential neutrophile count, and this is practically constant for all normal blood.

	I.	II.	III.	IV.	V.
100 neutrophiles	5	20	48	22	5

To make this as simple as possible, in order to chart it, a proportion between the two types of neutrophiles can be made as was suggested by Bushnell and Treuholtz,[2] that is, between those neutrophiles which have the fewer lobes, or Group I., Group II. and half of Group III. and those neutrophiles which have more lobes, or Group V., Group IV. and half of Group III.

[1] Arneth, "Die Lungenschwindsucht am Konig Juliuspital," Wurzburg, 1905.

[2] C. E. Bushnell and C. A. Treuholtz, *Medical Record*, March 21, 1908.

Since in normal blood the proportion is usually even, one can thus see at a glance to which side the number of pieces of the nucleus has shifted.

	I.	II.	III.	IV.	V.	
Blood from normal person	5	20	48	22	5	= 49:51
Blood from person with tuberculosis	20	32	40	8	0	= 72:28
Blood from person with infection ..	2	8	40	30	20	= 30:70

The results from my experiments seem to prove that the neutrophile reacts to changes in its environment by some change, probably metabolic, which involves the nucleus and that the state of the nucleus, together with the differential blood count, can be used as a guide as to the condition of the body.

Experiments where guinea pigs were inoculated with tuberculosis bacilli show that the neutrophile first reacts by a rapid increase in the number of lobes of its nucleus and then, later when the guinea pig reaches a state of definite tuberculosis, the neutrophile contains a nucleus of but one, two or three lobes.

Experiments of different sorts show that this same increase of the number of lobes of the nucleus can take place in blood outside the body in such a short time as five or ten minutes.

All the slides I have examined in the opsonic work show this same increase in the number of lobes of the nucleus and I might mention here that it seems a mistake to test certain serum with normal neutrophiles as is done in Wright's opsonic work, since the neutrophiles of the patient may have an entirely different ability to react, from those of the normal person.

Some toxins, especially snake toxin, has the same effect upon the neutrophiles and causes a great increase in the number of lobes of the nucleus.

Observations in the hospital, together with these experiments, seem to prove that the neutrophiles first react to the presence of bacilli or a toxin by some metabolic change, which is shown by increase in the number of lobes of the nucleus; these reacted cells then break down or are used up in the blood followed by